TCEQ Interoffice Memorandum

To: April Palmie, Project Manager, Superfund Section, Remediation Division

From: Vickie Reat, Technical Program Support Team, Division Support Section, Remediation Division

Date: October 12, 2012

Subject: Draft Baseline Ecological Risk Assessment (BERA) Report
Patrick Bayou Superfund Site
Deer Park, Texas
Prepared by Anchor QEA, LLC
August 2012

Per your request, I have reviewed the subject document. My comments are outlined in this memo. Dr. Linda Broach of the TCEQ Houston Region office also reviewed the document and provided comments.

Overall Comment

Using historical benthic community data from the site and nearby tidal bayous, the BERA concludes that the condition of the benthic community at the site does not differ significantly from local comparison sites, that there is no significant relationship between chemicals of potential concern (COPCs) and the condition of the benthic community, and that COPCs are not identified that represent an unacceptable adverse risk to the benthic community at the site. No risk management recommendations were deemed necessary for this receptor group. We disagree with this assessment.

First, we believe the benthic community evaluation was flawed for reasons outlined in the comments that follow. In fact, our analysis indicates that the benthic community in Patrick Bayou is degraded compared to the comparison sites presented in the BERA. This conclusion withstands even when data for the gunite-lined portion of the bayou is removed from the evaluation.

Secondly, Patrick Bayou appears impacted by site COPCs based on the other two legs of the sediment quality triad (i.e., Chapman 1990). Surficial sediment concentrations for mercury, PCBs (polychlorinated biphenyls), and Total PAHs (polycyclic aromatic hydrocarbons) consistently exceed the second effects level which indicate a concentration threshold above which adverse effects can frequently occur (i.e., Long et al 1995; TCEQ 2006). Additionally, sediment toxicity tests conducted as part of the TMDL (Total Maximum Daily Load) effort and by U.S. EPA/TCEQ indicated that site sediments were frequently toxic on multiple occasions at multiple locations (e.g., BERA work plan, Table 17).

As this was a draft document, we believe continued discussions with regulators should occur before the final BERA is submitted. We can provide details of our benthic

Re: August 2012 Draft Baseline Ecological Risk Assessment Report; Patrick Bayou Superfund Site

evaluation, and we can discuss potential responses to comments along with corresponding changes to the BERA. However, we believe the ultimate risk management decision for the benthic invertebrate exposure pathway should reflect a concentration-based remedial target for PAHs, mercury, and PCBs (and possibly some volatiles) in surficial sediments in Patrick Bayou that would be reasonably protective of the benthic community. Deeper sediments should also be targeted where sediment instability indicates potential future source areas of COPCs.

Specific Comments

1. 4.0 BERA Data Set - The information for notes a and b in Table 4-1 should be added.

2. 4.1.2.3 Toxic Equivalency Quotients - The table reference for the source of the toxic equivalency factors (TEFs) provided by U.S. EPA (2008) should be Table 4 rather than Table 4-2.

3. 4.7.2 Comparison Site Data - The discussion should include additional information on the benthic sample collection effort in Dobberstine (2007). In the Dobberstine study, five replicate 4-inch cores were collected at each sample location. This methodology results in a sediment sample volume of about 405 cm^2 compared to a volume of roughly 929 cm^2 for samples collected in Patrick Bayou. Normally in estuarine benthic communities, a few species are relatively abundant whereas other species are less abundant or relatively rare. Amphipods, gastropods, bivalves, and nemerteans are usually among these less common species. When smaller sample sizes are used, the rare species are often missed. This affects estimates of species richness and diversity because fewer species are found. This also affects any metrics that use these rarer species, such as percent bivalves, amphipods, or intolerant organisms. Please revise the BERA text.

4. 6.1.2.1.1 Prey Groupings - *Analysis by Prey Species* - Looking at Appendix C and Table 6-2, it seems appropriate that Gulf killifish as prey were separated out for assessing exposure to PCB toxic equivalent quotient (TEQ, avian) concentrations. However, it appears that PCB TEQ (avian) concentrations in Gulf menhaden and striped mullet were statistically higher than those for pinfish and sand sea trout. Why were these fish not separated out as well?

5. 6.1.2.1.1 Prey Groupings - *Spatial Trend Analysis* - Appendix C-1.2 displays plots of tissue concentrations by distance from the mouth of Patrick Bayou. The intent was to evaluate potential spatial trends in prey item concentrations along the bayou. Overall, the discussion indicates that significant spatial patterns were not apparent for most COPCs and species, and no prey subgroups were identified based on spatial

differences in COPC concentrations in prey tissue. The text in this section provides a few r^2 and p-values. No similar information was provided with the figures in Appendix C-1.2. The appendix should be revised to include this information, as appropriate, for each COPC/prey item pair.

6. 6.1.2.1.2 95 UCL - The exposure point concentrations (EPCs) for each receptor and their respective prey groups are provided in Table 6-3. For the most part, the various ProUCL summary pages indicating the 95% Upper Confidence Limits (UCLs) for each prey grouping were provided in Appendix C. However, we could not locate the 95% UCL information for the blue crab/oyster/white shrimp prey grouping. Please provide this information. Additionally, if a maximum or non-detect proxy value was used, please indicate this in Table 6-3.

7. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - Section 1.1 (Method Selection) of Appendix B compares inverse distance weighting (IDW) and Kriging interpolation methods using lead and hexachlorobenzene. Please present a similar comparison (graphics, calculated values) for PCBs (congeners, TEQ) since this was the primary risk driver for wildlife.

8. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - Was the gunite-lined portion of Patrick Bayou included in the SWAC calculations for wildlife? Either way, what was the basis for the decision?

9. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - Section 6.1.2.1 of the BERA work plan states that a hot spot analysis will be performed as part of the uncertainty assessment for the concentration term (i.e., $C_{k,SD}$) to evaluate if areas of elevated sediment COPC may occur within a foraging area that would lead to potentially higher exposure than indicated by use of a SWAC for this term. Was this done? If not, this evaluation should be added to the BERA.

10. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - *Methylmercury Estimates in Sediment* - Available site data were evaluated to estimate the proportion of methylmercury (MeHg) to total mercury in site sediments. These proportions were then used to estimate bulk sediment concentrations of MeHg and inorganic mercury for the incidental sediment ingestion pathway exposure assessment (for wildlife). In summary, estimates of MeHg in sediments were developed using simple equilibrium partitioning models and site-specific measurements of pore water MeHg, dissolved organic carbon (DOC), and bulk sediment total organic carbon (TOC). Details of this analysis are provided in Appendix C-3. Please provide a general discussion indicating why MeHg was not analyzed in site (bulk) sediment samples.

Re: August 2012 Draft Baseline Ecological Risk Assessment Report; Patrick Bayou Superfund Site

11. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - *Methylmercury Estimates in Sediment* - After a quick on-line search, it appears that the Skyllberg (2008) reference in Appendix C-3 is actually an article in *Journal of Geophysical Research – Biogeosciences*. Please update the reference as appropriate.

12. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - *Methylmercury Estimates in Sediment* - Using the formulas indicated in Appendix C-3, an estimated $MeHg_{sed}$ value was calculated for each sample location (Table 2 and 3) using bulk sediment TOC data for the nearest surface grab. It is unclear how the nearest surface grab was selected to pair with the pore water (DOC and MeHg) data. Also, since these analyses were not based on contemporaneous sampling events (2007 and 2009, footnotes page C-2), there is some uncertainty in the application of the assumptions. Please provide more information on both of these points.

13. 6.1.2.2.1 Sediment Surface Weighted Average Concentration (SWAC) - *Methylmercury Estimates in Sediment* - Please revise Appendix C-3 (page 2) to better explain the various depth intervals over which TOC concentrations (from any one sample location) were obtained and used in this approach. As it is, the draft language does not pair up with the information in Table 2 of the appendix. Anchor QEA representatives have proposed revised language in an e-mail to TCEQ.

14. 6.1.2.3 Terrestrial Animals and Plant Matter - Regarding terrestrial animals as prey for carnivorous birds and raccoons, the discussion states that none of these prey items would be expected to have significant exposure to bioaccumulative COPCs in site sediments and surface water; so, the terrestrial animal diet component for the raccoon and carnivorous birds was set to zero for the risk characterization. This statement is in conflict with a response to comment on the BERA work plan. In a comment regarding Section 6.2 of the work plan, we had asked (see page 20 of the response to comments table) if the intent was to model hypothetical exposure to terrestrial prey that have foraged within Patrick Bayou. The response was: "Yes, our intent is to model hypothetical exposure to terrestrial prey that may forage in Patrick Bayou (see Sections 6.2.2 and 6.2.4 in the BERA [work plan] for references to the equations we will use)." Please justify this apparent shift in the approach.

15. 6.1.3 Area Use Factors - We were not able to duplicate the average (belted kingfisher) and upper 75th percentile (belted kingfisher and spotted sandpiper) home range values provided in Table 6-5. Please verify these calculations.

16. 6.2.1 Development of Inorganic Mercury TRV (Toxicity Reference Value) - The avian LOAEL (lowest observed adverse effect level) TRV for Total PAH (325

mg/kg/day, Table 6-6) differs from the value of 40 mg/kg/day set out in the BERA work plan (Table 29). Please provide the justification for this change and present the derivation of the final value based on the LOAEL value in the cited study.

17. 6.3.2.4 Spotted Sandpiper - For the spotted sandpiper, incidental sediment ingestion was modeled as 18% of the total daily intake of food (Table 6-1). This conflicts with the value of 30% that was presented in the approved BERA work plan (Table 28 and Section 6.2.1). Please provide a justification for this move from the value presented in the BERA work plan.

18. 6.3.3.1.1 Prey Item Grouping - It does not appear that the uncertainty associated with Total PCB congeners was part of this analysis. Please add this COPC to the uncertainty evaluation or explain why it was excluded.

19. 6.3.3.1.1 Prey Item Grouping - Why were oysters excluded as food in the kingfisher evaluation (all prey species separate)?

20. 6.3.3.1.3 Area Use Factor (AUF) - To evaluate the potential uncertainty associated with the AUF, the AUF was varied for each receptor using the upper bound and lower bound home range estimates, and hazard quotients for each scenario were then determined. For the sandpiper, the hazard quotient for PCB Congener TEQ was 0.80 based on a lower-bound estimate of its home range and 3.1 based on an upper-bound estimate of its home range. Based on this evaluation, the BERA concludes that the uncertainty associated with the range of AUF values used in the baseline risk characterization is considered low. Given this outcome for the sandpiper evaluation, please discuss the conservatism and confidence in the AUF selected for the sandpiper.

21. 6.4 Risk Conclusions - The discussion repeats that for the spotted sandpiper, the uncertainty analysis indicates that the hazard quotient varies around one depending on the exposure assumptions, and that the hazard quotients range between 3.1 and 0.8 in the uncertainty analysis indicating that the probability of adverse effects above a LOAEL threshold are expected to be relatively low. The discussion adds that this generally translates into a low probability of adverse effects at the population level for this receptor group. Please provide more discussion regarding the potential for risks to the population level for this guild.

22. 7.1 Bioaccumulative COPCs Risk Assessment - The discussion at the beginning of this section states that based on the previous screening, the potentially bioaccumulative COPCs included in the BERA for fish are mercury, PCBs, and selenium. This conflicts with the BERA work plan which included dioxins/furans (as TEQ) as bioaccumulative COPCs for fish (from the surface water to fish pathway).

Re: August 2012 Draft Baseline Ecological Risk Assessment Report; Patrick Bayou Superfund Site

In fact, the March 2011 response to comment document (page 9) states the following: "Based on the results of the surface water screen for COPCs, dioxins/furans were identified as COPCs. We did state that due to the lack of a surface water screening value for dioxins/furans and the uncertainty with evaluating the bioavailability of dioxins/furans in the water column, an approach that used body burden data would be the best way to evaluate this COPC. As such, risks from dioxin/furan congeners in surface water will be assessed as a bioaccumulative COPC using a body burden approach for fish. Therefore, dioxins/furans will be included as an analyte in the fish and invertebrate SAP for the BERA." Please clarify if dioxins/furans were evaluated as bioaccumulative COPCs for fish as we do not see them in the summary tables for this section. If dioxins/furans were not evaluated in the BERA as a COPC for fish, please provide a robust rationale for this omission.

23. 7.1.1 Exposure Assessment - Looking at Appendix C and Appendix D, we could not find the presentation of the 95% UCL determination for the following combinations:

    - Mercury: all species
    - PCB Congener TEQ (Fish): GKF; all species
    - Total PCBs: GM, STM, PNF, SAS; all species

    Please provide this information.

24. 7.1.2 Tissue Based Effects Assessment - Details of the data used to derive the fish tissue-based selenium TRV were not provided in Appendix D. Please provide this information.

25. 7.3 Risk Conclusions - Based on the assessment of bioaccumulation-based and surface water exposures for fish, the BERA concludes there are no COPCs for fish. With the exception of selenium, this was primarily based on comparison of tissue residue-based TRVs with empirical tissue data for smaller (< 15 cm) fish collected from Patrick Bayou. In our comments on a draft of the BERA work plan, we had suggested collection of larger fish to more adequately assess the risks associated with bioaccumulative COPCs in Patrick Bayou. The final work plan stated (page 72) that "exploratory data analysis (e.g., coefficient of variation within and between species) will also be performed to assess the representativeness of larger size class fish (i.e., greater than 30 cm) as a measurement endpoint for the fish risk analysis and risk characterization." Was this analysis performed? If not, why not?

26. 8.0 Benthic Invertebrate Risk Assessment - The introductory discussion indicates that the BERA problem formulation identified three lines of evidence (LOEs) for

benthic invertebrate risk. These included an assessment of predicted sediment toxicity based on sediment chemistry and bioassay tests (i.e., the chemical and toxic LOE of the sediment quality triad); benthic indices that describe the condition of the benthic community; and a surface water exposure pathway risk assessment in which chemical concentrations in water are compared to TRVs derived for the protection of aquatic organisms. This conflicts with the problem formulation discussion (Section 3.3.1) of the BERA work plan which limited the benthic evaluation measurement endpoints to the use of a site-specific predictive sediment toxicity model and an evaluation of surface water exposure concentrations compared to water quality criteria. In fact, the work plan stated that the "predictive sediment toxicity model will be the primary measurement endpoint used to assess risks to the benthic invertebrate community on a site-wide basis." Please provide a clear explanation why the toxicity model was not presented in the BERA. Was the analysis performed?

27. 8.1.2 Benthic Predictive Model Risk Characterization - The discussion states that since a dose-response relationship for the sediment-toxicity dataset was not observed, this suggests that other mechanisms are acting to cause the observed mortality in test species. This is too broad of a statement. The toxicity demonstrated in the historical toxicity tests could have been a result of unique site COPCs or a combination thereof, or as a result of a combination of site COPCs and non-site COPCs. Please revise the BERA text.

28. 8.1.3 Applicability of Benthic Toxicity Predictive Model - This section states that *Leptocheirus* is not considered a representative receptor for the species expected to be found at the site. We disagree with this statement. Amphipods are an important component of estuarine macrobenthic communities, even in tidal streams. In 110 tidal stream samples collected by TCEQ between 1988 and 2008, amphipods were present in 21% of those samples (TCEQ unpublished data). In the Patrick Bayou samples presented in the BERA, amphipods were present in 18% of the samples. In the Dobberstine (2007) study (presented in the BERA), amphipods were only present in 8% of the samples. The most likely reason for this difference in abundance is that less sediment volume was collected in the Dobberstine (2007) study compared to the benthic evaluations performed as part of the TMDL effort and the TCEQ's benthic evaluations. As a result, these less abundant organisms were simply missed.

29. 8.2.1.1 Setting and General Conditions - This discussion should be revised so that it is clear that the areas of Patrick Bayou that are channelized or that have patchy benthic habitat are limited to the upper gunite-lined portion. This only affects four benthic sampling locations. The remainder of Patrick Bayou exhibits typical benthic habitat, which is not patchy or overly scoured. In fact, the benthic habitat in the

lower portion of Patrick Bayou is less disturbed than that of other comparison tidal streams (e.g., Carpenter Bayou and Cedar Bayou are both channelized for much of their lower length and both are used for barge traffic). Additionally, Patrick Bayou is not subject to boat traffic (and its associated prop washing) because of the low bridge near the mouth of the bayou.

30. 8.2.2 Benthic Community Measurement Endpoints - This section of the BERA used two different benthic indices to evaluate the Patrick Bayou benthic community data compared with a group of reference sites sampled by Dobberstine (2007). Both of these benthic indices were developed using primarily open bay stations across the northern Gulf of Mexico. Neither of these indices have been used or tested in tidal streams. Similar to the Dobberstine et al. (2007) reference in Section 8.2.1.5, tidal streams are not expected to have the same macrobenthic community composition as open bay sites. It is not appropriate to use these open bay indexes to assess a tidal stream such as Patrick Bayou.

    In developing quantitative biocriteria, U.S. EPA guidance suggests using measures of diversity, richness, trophic structure, and the presence or absence of species that are considered tolerant or intolerant in comparison to a population of reference sites (U.S. EPA, 2000). In the absence of a tested index for tidal streams, we suggest evaluating the benthic community in Patrick Bayou and reference locations using five traditional metrics. The metrics we recommend are: species richness, diversity, percent dominance, percent tolerant individuals, and percent intolerant individuals. We evaluated the Patrick Bayou and comparison tidal stream benthic data using these five metrics in addition to a novel metric that evaluates the presence or absence of five major taxonomic groups that are generally present in tidal stream benthic communities. These six metrics performed well in evaluations of tidal stream reference and degraded benthic communities in the Galveston Bay system (Broach, unpublished data). The first five of these metrics are very commonly used in benthic assessments, and have been shown to be applicable to many biological systems, especially for invertebrate populations. A white paper that discusses these metrics and the Patrick Bayou benthic communities in more detail will be provided soon and can be presented to the JDG in an interactive format.

    Essentially, when these basic measures of benthic community health are evaluated, Patrick Bayou benthos are impaired compared to other tidal streams in the Galveston Bay system. Patrick Bayou has fewer species, lower diversity, fewer intolerant individuals, and more tolerant individuals than the other bayous evaluated. This comparison includes sample locations evaluated in Dobberstine (2007) where many important species were likely missed because of the much smaller sample volumes in that study.

Re: August 2012 Draft Baseline Ecological Risk Assessment Report; Patrick Bayou Superfund Site

31. 8.2.2.1 Benthic Indices (and Figures 8-8 and 8-11) - In the BERA evaluation of benthic community data (using these indices), benthic data from different seasons were combined. Macrobenthic communities show large seasonal fluctuations. For this reason, both of these indices were developed using summer data only. Summer data should not be combined with data from other seasons when evaluating macrobenthic communities. The statements that discuss the variability in the benthic scores over time and season should acknowledge that seasonal changes are expected. Further, the discussions should not attempt to use these differences as evidence that COPCs are not affecting the benthic community. Summer and non-summer scores are not expected to be the same.

32. 8.4.1 Exposure Assessment - The recommended total PCB 95% UCL was calculated to be 193 ng/L. Calculations are summarized in Appendix E-4, and the surface water data is presented in Appendix A-2. We calculated a slightly higher value (220 ng/L) based on the values in Table A-2 which totaled 21 values, rather than 25. Please verify the data set and explain the discrepancy (if confirmed).

33. 8.4.2 Effects Assessment - The BERA proposed an alternate final chronic value (protective of benthos) of 540 ng/L based on the presentation in Fuchsman, et al. (2006). This paper relied on toxicity data for Aroclor 1254 to derive the final acute value (FAV) and acute and chronic toxicity data for Aroclors 1242, 1248, and 1254 to calculate the acute-to-chronic ratio. Since the Patrick Bayou surface water data was based on total congeners rather than Aroclors, please discuss the uncertainty associated with this approach.

34. 8.5.2 Surface Water - Based on the alternate PCB surface water chronic value used, the BERA concludes that risk to benthic invertebrates from PCBs in surface water is determined to be negligible and no surface water COPCs are identified. We understand the basis for this statement. However, the PCB concentration (193 ng/L 95% UCL) exceeds the Texas Surface Water Quality Standard chronic criterion of 30 ng/L. This should be addressed later in the Superfund process.

35. 10.0 Conclusions and Risk Management Recommendations - We disagree with the conclusions regarding the evaluation of risks to the benthic invertebrate community and will revisit the risk management recommendations for this pathway after revision of the BERA and/or development of a consensus-based remedial target for the COPC risk drivers for this pathway. By consensus we mean a collective decision from the JDG, regulators, and Trustee agencies, where possible.

Re: August 2012 Draft Baseline Ecological Risk Assessment Report; Patrick Bayou Superfund Site

References

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